Analysis of Coulomb-excitation yields in ^{235}U

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Analysis of thick-target yields measured with an ^{40}Ar beam at 180 MeV is completed. In this experiment, Gammasphere was used in conjunction with the CHICO detector to record gammarays in coincidence with scattered ^{40}Ar ions. The observed and calculated yields were normalised to those of the E2 cascades in the ground-state band averaged from J=17/2 to J=27/2 which are reliably predicted with the Coulomb-excitation code together with the calculated conversion coefficients and the measured gamma-ray branching ratios.

The Coulomb-excitation probabilities depend on many matrix elements and model assumptions are unavoidable. We take the rotor values with Q=9.75 eb. for the E2 matrix elements within all bands. Matrix elements linking a band to the ground-state band were taken from:

$$B(E\lambda; J_i \rightarrow J_f) = \frac{(2\lambda+1)}{(16\pi)} e^2 . Q_t^2(\lambda) . (CG)^2 \qquad (1)$$

where $Q_t(\lambda=2)$ and $Q_t(\lambda=3)$ transition moments play an analogous role to the intrinsic moments $Q_0(\lambda=2)$ and $Q_0(\lambda=3)$. The Clebsch-Gordon coefficient is abreviated as (CG). We fit the yield of all measured states in a band to a single $Q_t(\lambda=2)$, or $Q_t(\lambda=3)$ value. For the gamma-vibrational bands we also included the mixing parameter introduced by Bohr and Mottelson [1]. Generally, the shapes of the observed yield curves follow the predictions. An example is shown in Fig 1. The only significant failure is for the K=11/2 gamma-vibration (cf [2]) and we now realise that there is an "avoided crossing" between the Nilsson [734]9/2 band and the K=11/2 gamma band at spin 17/2 which accounts for this anomalous behavior.

As pointed out in ref 1, if the intrinsic E2 matrix elements between two ΔK=1 bands are negligibly small, then the E2 matrix elements arising from Coriolis mixing follow the exact form of equation(1), and $Q_t(\lambda=2)$ is proportional to the mixing amplitude. The measured $Q_t(\lambda=2)$ values for the [752]5/2 and [734]9/2 are then direct measures of the Coriolis mixing to the ground state [743]7/2 band.

Some eight positive-parity rotational bands were measured with $Q_t(\lambda=3)$-values ranging from 0.6 to 1.8 e 10^{-36} cm^3. This represents a relatively large E3 collectivity, and calculations are underway to try to understand this, and its possible connection to the attenuation of Coriolis matrix elements.

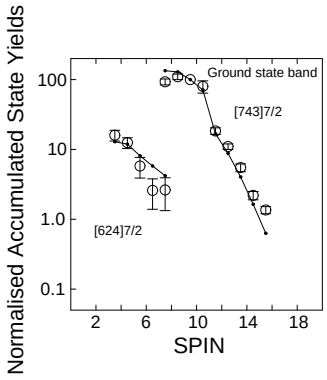

FIG. 1: Measured and calculated yields for rotational bands in ^{235}U. Note that the ground-band values refer only to the E2 gamma branch. The result for the [624]7/2 band is $Q_t(\lambda=3)$=1.03 e 10^{-36} cm^3.

REFERENCES

[1] A. Bohr and B.R.Mottelson, Nuclear Structure pp. 146,152 (1975).

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